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THE UPPER CRETACEOUS AMMONITE GENUS BARROISICERAS
IN THE UNITED STATES

BY

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THE UPPER CRETACEOUS AMMONITE GENUS BARROISICERAS IN THE UNITED STATES

By JOHN B. REESIDE, Jr.

INTRODUCTION

The ammonite genus *Barroisiceras* Grossouvre is noteworthy because of its wide geographic distribution and its apparently small stratigraphic range. It is reported from deposits of Coniacian age in Europe, Africa, South America, and North America. In the North American Upper Cretaceous it is rather rare, authentic species having been recognized hitherto only in the Austin chalk of Texas, in the Coniacian beds of Zumpango del Rio, Guerrero, Mexico, and, with doubt as to the source, in New Jersey. The Texan species, *B. dentatocarinatum* (Roemer), is by no means an abundant form, though among those described in early work in the region. The Mexican representatives of the genus thus far described include only fragmentary specimens not specifically named. The occurrence ascribed to New Jersey is based on a fragment that seems to belong to *Barroisiceras* but whose source is very doubtful.

The present paper records, in addition to *B. dentatocarinatum*, five new species from the Interior Province and one from Texas. Five of these are represented by single specimens and one by two specimens, but all are well characterized and deserving of recognition in spite of scant material. Three of the new species are associated with other invertebrates of early Niobrara (early Coniacian) age and come from one locality in the Mancos shale of central Utah. A fourth is likewise associated with invertebrates of Niobrara age and comes from the Frontier sandstone near Lander, Wyo. The fifth new species is from the Timpas limestone, the lower formation of Niobrara age, near Carlisle Springs, Colo. The sixth is from the Austin chalk north of Sabinal, Tex.

Mr. W. O. Hazard photographed the specimens shown in the plates, and Miss Frances Wieser retouched the photographs and assembled the plates.

TAXONOMIC HISTORY OF THE GENUS BARROISICERAS GROSSOUVRE

The genus *Barroisiceras* was instituted by Grossouvre¹ in 1894, with *Ammonites haberfellneri* Hauer² as the first species and chief basis of the genus.

¹ Grossouvre, Albert de, Les ammonites de la Craie supérieure: Carte géol. France Mém., Recherches sur la Craie supérieure, pt. 2, Paléontologie, pp. 80-81, 1893 [1894].

² Hauer, Franz von, Neue Cephalopoden aus den Gosaugebilden der Alpen: K. Akad. Wiss. Wien Sitzungsber., Band 53, Abt. 1, p. 301, pl. 1, figs. 1-5, 1866.

The name was printed in the original text as *Barroisia*, but as this name had been applied to a genus of sponges in 1882 by Munier-Chalmas, Grossouvre in an added note altered the form of his new term to *Barroisiceras*. Grossouvre's characterization of the genus consisted chiefly of a comparison of the suture with that of *Tissotia* Douvillé, in which it was stated that *Barroisiceras* differed in having fewer lobes, greater incision of the elements, and the larger member of the unsymmetrically bifid external saddle on the siphonal side. Grossouvre's figures and discussion of the species afforded other characters, however, useful for recognition of the genus. The species *haberfellneri* was given a very wide scope and included besides the typical form the varieties *alstadenensis* Schlüter,³ *démoulini* Grossouvre, and *harlei* Grossouvre. The other species recognized were *B. nicklesi* Grossouvre, *B. sequens* Grossouvre, and *B. boisselleri* Grossouvre. Under *B. haberfellneri* Grossouvre included—in addition to Schlüter's *Ammonites alstadenensis*—*A. petrocoriensis* Coquand,⁴ *A. neptuni* Fritsch, and Schlönbach (not Geinitz),⁵ *A. dentato-carinatus* Fritsch and Schlönbach (not Roemer),⁶ *A. paeon* Redtenbacher,⁷ and *Buchiceras nardini* Fallot.⁸ Grossouvre suggested also that *Schloenbachia tunetana* Peron⁹ may be a *Barroisiceras* but stated that he did not know any Indian or American species.

Peron¹⁰ in 1897 noted *B. haberfellneri* Grossouvre in Algeria, doubting, however, the validity of uniting with it *Ammonites petrocoriensis* Coquand.

Anderson¹¹ in 1902 included *Barroisiceras* in *Schloenbachia*, referring to it two species, *S. (B.) siskiyouensis*

³ Schlüter, Clemens, Cephalopoden der oberen deutschen Kreide: Palaeontographica, Band 24, p. 151, pl. 40, figs. 13-16, 1876.

⁴ Coquand, Henri, Synopsis des animaux et des végétaux fossiles observés dans la formation crétacée du sud-ouest de la France: Soc. géol. France Bull., 2d ser., vol. 16, p. 995, 1858.

⁵ Fritsch, Anton, and Schlönbach, Urban, Cephalopoden der böhmischen Kreideformation, p. 30, pl. 15, fig. 3, Prague, 1872.

⁶ Idem, p. 32, pl. 16, figs. 1-3.

⁷ Redtenbacher, Anton, Die Cephalopodenfauna der Gosauschichten in den nordöstlichen Alpen: K.-k. geol. Reichsanstalt Abh., Band 5, p. 103, pl. 23, fig. 3, 1875.

⁸ Fallot, J. E., Étude géologique sur les étages moyens et supérieurs du terrain crétacé dans le sud-est de la France: Annales sci. géol., vol. 18, p. 241, pl. 3, figs. 3-4, 1885.

⁹ Peron, Alphonse, Description des invertébrés fossiles des terrains crétacés de la région sud des hauts-plateaux de la Tunisie recueillis en 1885 et 1886 par M. Philippe Thomas, pp. 21-23, pl. 17, figs. 6-8, 1893.

¹⁰ Peron, Alphonse, Les ammonites du Crétacé supérieur de l'Algérie: Soc. géol. France Mém. 17, p. 48, 1897.

¹¹ Anderson, F. M., Cretaceous deposits of the Pacific coast: California Acad. Sci. Proc., 3d ser., vol. 2, no. 1, pp. 119-120, 1902.

Anderson and *S. (B.) knighteni* Anderson, from the lower part of the Chico formation of Oregon and California. It is difficult to judge Anderson's figures and descriptions, but the assignment to *Barroisiceras* seems doubtful because of the sigmoid curvature of the ribs, weak marginal tubercles, and other features. It is also highly probable that the lower Chico is older than any beds containing true *Barroisiceras*.

Hyatt¹² in 1900 in a general arrangement of the Ammonoidea assigned *Barroisiceras* to the family Mammitidae, giving only a brief discussion of the family. He included with *Barroisiceras* and *Mammites* his new genera *Calycoceras* and *Metacanthoplites*, the latter based on *Ammonites rhotomagensis* Defrance, now generally accepted as the genotype of *Acanthoceras*.

Hyatt¹³ in 1903 interpreted the genus, apparently on the basis of Grossouvre's published data only, as possessing smooth, compressed young with continuous keel; successive later stages with ribs and a smooth keel; with ribs, nodes, and a nodose keel; finally with a smooth keel again. He considered the several varieties of *B. haberfellneri* to be distinct species and named one of Grossouvre's figured but unnamed variants of this species *B. haueri*.

Shattuck¹⁴ in 1903 referred to *Barroisiceras* two species from the Buda limestone of Texas as *B. texanum* Shattuck and *B. hyatti* Shattuck. The horizon of these forms is considerably below that of other species included in the genus, and both have since been placed in *Budaiceras* Böse, as noted below.

Solger¹⁵ in 1904, in a discussion of fossils from Kamerun, gave the first real description of *Barroisiceras*, which may be translated as follows:

Shell high-whorled and with rather narrow umbilicus except in the old-age stages of some forms. Periphery with a smooth or nodose keel accompanied on either side by a row of nodes or a smooth slope.

Flanks smooth or bearing rounded ribs, sometimes also umbilical nodes and a row of median-lateral nodes, both in smaller number than the marginal nodes, to which they send rounded ribs.

Suture with three saddles of about equal height, sometimes the beginning of a fourth. Lobes plump, toothed over the entire outline or running out into short, toothed branches. First lateral more strongly dissected on the external side than on the internal (umbilical) side. Saddles rounded, more or less clearly bifid.

Type: *Barroisiceras haberfellneri* (F. v. Hauer).

Solger thought *Barroisiceras* better separated from *Tissotia* by the general form of the lobes and the entire saddles of the second genus. He also considered it close to *Mortonicer*, but separable by its smaller

umbilicus and forked ribs, and to *Gauthiericeras*, but separable by its lesser involution, shallow furrows bordering the median keel, and the sharp decrease inward in the height of the sutural elements. Solger raised the variety *desmoulini* Grossouvre to specific rank because specimens from Africa studied by him and assigned to it possess a smooth keel at all stages, and he described the new species *B. brancoi*, dividing it into the two varieties *mitis* and *armata*.

Lasswitz¹⁶ in 1904 assigned to *Schloenbachia* (*Barroisiceras*) a number of species from Texas, supposing them to be of Coniacian age. They have since been found to be much older and recently have been placed by Böse¹⁷ for the greater part in his genus *Budaiceras*. Only the species *dentatocarinatum* Roemer¹⁸ appears to be an authentic *Barroisiceras*.

Pervinquier¹⁹ in 1907 accepted Solger's diagnosis of the genus; added a new species, *B. romieuxi*, and a new variety, *byzacenicum*, of *B. haberfellneri*; and, following Grossouvre's suggestion, assigned to the genus *Schloenbachia tunetana* Thomas and Peron with a new variety, *inermis*, under it. He listed as species of *Barroisiceras* *B. haberfellneri* (Von Hauer), with varieties *alstadenense* (Schlüter), *harlei* Grossouvre, and *byzacenicum* Pervinquier; *B. nicklesi* Grossouvre; *B. desmoulini* Grossouvre; *B. tunetana* (Thomas and Peron), with variety *inermis* Pervinquier; *B. sequens* Grossouvre; *B. boisselleri* Grossouvre; *B. brancoi* Solger, with varieties *mitis* Solger and *armatum* Solger; and *B. romieuxi* Pervinquier. He rejected *B. texanum* Shattuck and *B. hyatti* Shattuck as doubtful, a procedure justified by their later inclusion in *Budaiceras*. He did not note *B. haueri* Hyatt and ignored the forms cited by Lasswitz from Texas.

Weller²⁰ in 1907 refigured and described as *Barroisiceras dentato-carinatus* Roemer a fragment of a whorl of an ammonite which Whitfield²¹ had earlier figured as *Ammonites dentato-carinatus*. The specimen is hardly *B. dentatocarinatum*, for it is described as showing on the flanks "two lines of nodes which divide the surface into three nearly equal spaces," though it seems surely to be a *Barroisiceras*. The horizon and locality of the specimen are unknown, though Whitfield stated that it was labeled "Cretaceous of New Jersey" and suggested from the lithology that it might have come from the base of the "Lower Green Marls." This horizon is well above that of any species of *Barroisiceras* yet recorded from any part of the world, and the

¹² Hyatt, Alpheus, in Zittel, K. A. von, Textbook of paleontology, 1st ed. (translated by C. R. Eastman), Ammonoidea, p. 588, 1900.

¹³ Hyatt, Alpheus, Pseudoceratites of the Cretaceous: U. S. Geol. Survey Mon. 44, p. 104, 1903.

¹⁴ Shattuck, G. B., The Mollusca of the Buda limestone: U. S. Geol. Survey Bull. 205, pp. 35-36, pl. 25, 1903.

¹⁵ Solger, Friedrich, Die Fossilien der Mungokreide in Kamerun und ihre geologische Bedeutung, in Esch, Ernst, and others, Beiträge zur Geologie von Kamerun, pt. 2, pp. 163-179, Stuttgart, 1904.

¹⁶ Lasswitz, Rudolf, Die Kreide-Ammoniten von Texas: Paleont. Abh., n. F., Band 6, pp. 246-250, 1904.

¹⁷ Böse, Emil, Cretaceous ammonites from Texas and northern Mexico: Texas Univ. Bull. 2748, pp. 91, 162, 255, 1927.

¹⁸ Roemer, Ferdinand, Die Kreidebildungen von Texas und ihre organischen Einschlüsse, p. 33, pl. 1, fig. 2, Bonn, 1852.

¹⁹ Pervinquier, Léon, Études de paléontologie tunisienne, pt. 1, Céphalopodes des terrains secondaires, pp. 379-385, Paris, 1907.

²⁰ Weller, Stuart, Cretaceous paleontology of New Jersey: New Jersey Geol. Survey, Paleont. ser., vol. 4, p. 836, pl. 101, figs. 5-6, 1907.

²¹ Whitfield, R. P., Gasteropoda and Cephalopoda of the Raritan clays and greensand marls of New Jersey: U. S. Geol. Survey Mon. 18, p. 250, pl. 41, figs. 3-4, 1892.

description of the lithology suggests to the writer that the specimen did not originate in New Jersey but came from some other source, possibly even as far away as the Austin chalk of Texas. The record is so doubtful that it would best be left out of consideration.

Boule, Lemoine, and Thevenin²² in 1907 included *Barroisiceras* in *Schloenbachia* and reduced to the status of a variety of *B. haberfellneri* Grossouvre's *B. nicklesi*. They noted *B. haberfellneri* from Madagascar in the typical form and in the varieties *harlei* and *nicklesi* Grossouvre. A Senonian species described by them as *Acanthoceras* (*Prionotropis*) *allaudi* seems to the present writer almost surely a *Barroisiceras*.

Brüggen²³ in 1910 cited *Barroisiceras haberfellneri* and *B. brancoi* var. *mite* Solger from Peru, viewing the first species in the broad sense of Boule, Lemoine, and Thevenin.

Douvillé²⁴ in 1911 included *Barroisiceras* in the subfamily Mortoniceratinae under the family Pulchellidae, considering chiefly the suture. He placed the genus close to *Prionocyclus* and *Prionotropis* because of the dentate keel.

Smith²⁵ in 1913, in a general arrangement of the Ammonoidea, included *Barroisiceras* both in the subfamily Acanthoceratinae under the family Cosmocerotidae and in the family Prionotropidae. As the work was a revision of Hyatt's earlier arrangement of the genera of ammonites, possibly the first assignment was an accidental inheritance from Hyatt and the second Smith's real opinion.

Lüthy²⁶ in 1918 identified *Schloenbachia* (*Barroisiceras*) *brancoi* var. *mite* Solger in Peru and a second, new but unnamed species.

Burckhardt²⁷ in 1919 described many fragmentary specimens of *Barroisiceras* from Mexico. He divided his specimens into four groups—(1) forms comparable to typical *B. haberfellneri* and to *B. neptuni* Fritsch and Schlönbach (not Geinitz), with ribs well developed and strong umbilical and marginal tubercles; (2) forms comparable to *B. haberfellneri* var. *harlei* Grossouvre, with ribs almost entirely suppressed and with umbilical and marginal tubercles fine and like short, delicate ribs; (3) forms comparable to *B. petrocoriense* Coquand and *B. haberfellneri* var. *nicklesi* Boule, Lemoine, and Thevenin (not Grossouvre), with weak ribs but strong umbilical and marginal tubercles; (4) forms comparable to *B. alstadenense* Solger (not of authors) and *B. alstadenense* (Schlüter), with ribs fairly well

marked but in some forms weak and with median-lateral tubercles in addition to the marginal tubercles, especially in youth.

Broili²⁸ in 1924 included *Barroisiceras* in the Prionotropidae, giving the brief diagnosis:

Umbilicus narrow. Ribs mostly with lateral nodes, at which they fork, ending in marginal nodes. Saddles and lobes broad, little dissected.

Under the family diagnosis the suture is characterized as having bifid lateral lobes and one auxiliary lobe.

Scott²⁹ in 1926 assigned to *Barroisiceras haberfellneri* (Hauer) Roemer's *Ammonites dentato-carinatus*.

Adkins³⁰ in 1926 briefly characterized *Barroisiceras* as having a coarsely serrated carina and accepted *B. dentatocarinatum* (Roemer) as a valid species.

SPECIES RECORDED IN THE LITERATURE

The species and varieties recorded in the preceding summary of the literature and those described in this paper (pp. 15–19) constitute a rather varied assortment of forms. It has seemed worth while, as an aid in studying the genus, to state briefly the chief characters of each species and to attempt an arrangement into convenient groups on the basis of form and sculpture, even though the writer has had in hand material representing only the North American species and has had to use published descriptions and figures alone for the others. The species already removed from *Barroisiceras* and assigned to *Budaiceras* need no further consideration. Others originally called varieties seem in large part deserving of independent rank and are so treated. Some forms originally placed under a single name are separated, though in the absence of specimens new names are not applied. The groups, together with brief notes on the included species, are as follows:

I. Median-ventral nodes equal in number to the marginal nodes.

1. Ribs straight.

A. Strong umbilical and marginal nodes.

a. Ribs well developed.

haberfellneri (Hauer), s. s. Hauer, p. 300, pl. 1, figs. 1–4, 1866; Grossouvre, p. 51, pl. 1, figs. 1–3, 5 (not 4), 1894; Boule, Lemoine, and Thevenin, p. 43, pl. 11, fig. 3, 1907. Shell moderately stout; nodes strong, 6 to 9 per whorl at umbilicus, 18 to 20 on venter. Large individuals lose the median-ventral nodes and acquire a concave venter bordered by the marginal nodes. Umbilicus one-sixth diameter.

haueri Hyatt. Grossouvre, p. 51, pl. 2, fig. 1, 1894; Hyatt, p. 105, 1903. Much stouter than *haberfellneri* and with coarser sculpture. Umbilicus one-fifth diameter.

²² Boule, Marcellin, Lemoine, Paul, and Thevenin, Armand, Paléontologie de Madagascar; III, Céphalopodes crétacés des environs de Diégo-Suarez: Annales de paléontologie, vol. 2, pp. 14, 23–25, 1907.

²³ Brüggen, Hans, Die Fauna des unteren Senons von Nord-Peru: Neues Jahrb., Beilage-Band 30, pp. 730–733, 1910.

²⁴ Douvillé, Henri, Évolution et classification des pulchellidés: Soc. géol. France Bull., 4th ser., vol. 11, p. 295, 1911.

²⁵ Smith, J. P., in Zittel, K. A. von, op. cit., 2d ed., Ammonoidea, pp. 669, 672, 1913.

²⁶ Lüthy, Jacob, Beitrag zur Geologie und Paläontologie von Peru: Soc. paléont. Suisse Mém., vol. 43, pp. 48–50, pl. 4, figs. 1–2, 1918.

²⁷ Burckhardt, Carlos, Faunas jurásicas de Symon (Zacatecas y faunas cretácicas de Zumpango del Río (Guerrero): Inst. geol. México Bol. 33, pp. 99–108, pls. 24–25, 1919.

²⁸ Broili, Ferdinand, in Zittel, K. A. von, Grundzüge der Paläontologie (Paläozoologie), Abt. 1, Invertebrata, 6th ed., p. 593, Munich, 1924. Previous editions of this work treat *Barroisiceras* in the same manner.

²⁹ Scott, Gayle, Études stratigraphiques et paléontologiques sur les terrains crétacés du Texas: Grenoble Univ. Annales, new ser., Sci. sec., vol. 3, p. 109, 1926.

³⁰ Adkins, W. S., Handbook of Texas Cretaceous fossils: Texas Univ. Bull. 2838, pp. 203, 252, 1928.

I. Median-ventral nodes equal in number to the marginal nodes.

1. Ribs straight—Continued.

A. Strong umbilical and marginal nodes—Continued.

a. Ribs well developed—Continued.

neptuni (Fritsch and Schlönbach) (not Geinitz). Fritsch and Schlönbach, p. 30, pl. 14, fig. 3, 1872. Much like *haberfellneri* but with weaker sculpture. Umbilicus one-sixth diameter.

dentatocarinatum (Fritsch and Schlönbach) (not Roemer). Fritsch and Schlönbach, p. 32, pl. 16, figs. 1-3, 1872. Rather compressed, ribs on flanks weaker than in *haberfellneri*; nodes about same number as in *haberfellneri*, but umbilical nodes accentuated. Umbilicus one-fourth diameter.

paeon (Redtenbacher). Redtenbacher, p. 103, pl. 23, fig. 3, 1875. Rather compressed; in earlier whorls 9 umbilical nodes and 24 ventral nodes; in later whorls ventral nodes unite in a high, smooth keel and marginal nodes weaken. Umbilicus one-eighth diameter.

b. Ribs weak.

dentatocarinatum (Roemer). Roemer, p. 33, pl. 1, fig. 2, 1852. Shell much compressed; ventral nodes high and sharp; 5 umbilical, 25 ventral nodes per whorl; in large adults the marginal nodes pass into distant blunt spines. Umbilicus one-fourth diameter.

petrocoriense (Coquand). Grossouvre, p. 51, pl. 2, fig. 5, 1894. In early stages ribs and nodes distinct, 8 umbilical and 18 ventral nodes per whorl; in later stages ribs and umbilical nodes vanish. Umbilicus one-sixth diameter.

dartoni Reeside. This paper, p. 16, pl. 6, figs. 8-10; pl. 5, figs. 8-9. Shell compressed, cross section of whorl high oval; 11 umbilical, 20 marginal and ventral nodes per whorl, persisting to end of shell. Umbilicus two-sevenths diameter.

nicklesi Grossouvre. Grossouvre, p. 63, pl. 3, fig. 2, 1894. Shell much compressed; 8 coarse umbilical and 20 ventral nodes per whorl; ribs obscure; keel faint and scarcely tuberculate in later stages. Mature cross section subquadrate. Umbilicus one-fourth diameter.

nicklesi Boule, Lemoine, and Thevenin (not Grossouvre). Boule, Lemoine, and Thevenin, p. 45, pl. 11, fig. 2, 1907. Shell stouter than in *nicklesi* s. s., umbilicus smaller and umbilical nodes weaker; median-ventral nodes persist to a larger stage. Umbilicus one-fifth diameter.

nardini (Fallot). Fallot, p. 241, pl. 3, figs. 3-4, 1885. Shell compressed; 8 coarse umbilical and 16 marginal nodes per whorl; former on sharp umbilical shoulder; ribs weak in early stages and absent in middle and later stages. Mature cross section subquadrate. Umbilicus one-fifth diameter.

I. Median-ventral nodes equal in number to the marginal nodes.

1. Ribs straight—Continued.

B. Median-lateral as well as umbilical and marginal nodes.

a. Ribs distinct; median-lateral nodes not stronger than others; shell relatively compressed.

alstadenense (Schlüter). Schlüter, p. 151, pl. 40, figs. 13-16, 1876; Grossouvre, p. 51, pl. 1, fig. 4, pl. 2, fig. 4, 1894. In earlier stages 7 umbilical and median-lateral nodes and 21 ventral nodes per whorl; in later stages ribs and nodes disappear except marginal nodes. Umbilicus one-sixth diameter.

alstadenense Solger (not Schlüter). Solger, p. 170, pl. 5, fig. 6, 1904. Umbilical and median-lateral nodes weak, marginal and median-ventral nodes strong; ribs persist longer than in *alstadenense* s. s.; only 2 marginal nodes for each umbilical node. Umbilicus one-fifth diameter.

sevierense Reeside. This paper, p. 16, pl. 4, figs. 4-8. Nodes and ribs moderately strong; 10 umbilical and median-lateral nodes, 16 marginal and median-ventral nodes per whorl, all persistent. Umbilicus one-fifth diameter.

b. Ribs very weak; median-lateral nodes prominent; shell relatively stout.

forresteri Reeside. This paper, p. 17, pl. 5, figs. 2-7. Blunt spinelike median-lateral and marginal nodes, weak umbilical and median-ventral nodes; 12 umbilical and median-lateral nodes, 18 marginal and median-ventral nodes per whorl. Umbilicus one-fourth diameter.

allaudi (Boule, Lemoine, and Thevenin). Boule, Lemoine, and Thevenin, p. 32, pl. 8, figs. 6-7; text fig. 17, 1907. Blunt spine-like median-lateral and marginal nodes, weak umbilical and median-ventral nodes; 15 umbilical and median-lateral nodes, 23 marginal and median-ventral nodes per whorl. Umbilicus one-fourth diameter.

stantoni Reeside. This paper, p. 17, pl. 7, figs. 1-7; pl. 6, figs. 1-3; pl. 7, fig. 1. In early stages median-lateral nodes not much more prominent than the others; in later stages umbilical and median-lateral nodes are joined by high rib and become conspicuous; all the nodes persistent. Umbilicus one-third diameter.

hobsoni Reeside. This paper, p. 18, pl. 9, figs. 2-4; pl. 8, figs. 1-2. In early stages umbilical nodes fairly strong, others of same size; in later stages umbilical nodes disappear, each third median-lateral node becomes a strong blunt spine, and the median-ventral nodes weaken somewhat. Umbilicus one-third diameter.

I. Median-ventral nodes equal in number to the marginal nodes.

1. Ribs straight—Continued.

C. Sculpture very weak; ribs weak or absent; marginal nodes strongest, median-ventral next, umbilical nodes weak or absent. Shell compressed.

a. Small species with small umbilicus and sharp-ventered adults.

harlei Grossouvre. Grossouvre, p. 51, pl. 2, figs. 2, 7, 8, 1894; Boule, Lemoine, and Thevenin, p. 43, pl. 11, fig. 4, 1907. In early stages faint ribs, very weak elongated umbilical nodes, marginal and median-ventral nodes; in later stages flanks, ventral slope, and keel smooth, only marginal nodes remain. Cross section of whorl subtriangular, widest near umbilicus. Umbilicus one-eighth diameter.

byzacenicum Pervinquier. Pervinquier, p. 381, 1907. Like *harlei* but with 6 rounded umbilical nodes per whorl.

castellense Reeside. This paper, p. 19, pl. 6, figs. 1-5. Ribs and nodes weak but persistent; 8 rounded umbilical nodes per whorl. Cross section of whorl suboval, widest at the middle. Umbilicus one-eighth diameter.

b. Large species with round-ventered adults; umbilicus large.

brancoi var. *mite* Solger. Solger, p. 174, pl. 5, figs. 4-5, 1904. In early stages umbilical nodes very weak, marginal and ventral nodes distinct, ribs 35 per whorl; in later stages ribs fade, nodes weaken, and venter becomes subrounded. Umbilicus one-sixth diameter.

brancoi var. *armatum* Solger. Solger, p. 177, pl. 5, figs. 1-2, 1904. In early stages ribs weak, 25 per whorl, umbilical nodes absent, marginal and ventral nodes strong; in later stages distantly spaced marginal spines replace marginal nodes, venter is rounded. Umbilicus one-fifth diameter.

romieuvi Pervinquier. Pervinquier, p. 383, pl. 12, fig. 12, 1907. Ribs only on outer half of flank, marginal and median-ventral nodes distinct at large stage. Cross section of whorl subquadrate. Umbilicus one-fourth diameter.

2. Ribs sigmoid.

A. Keel nodose; ribs strong and coarse.

siskiyouense Anderson. Anderson, p. 119, pl. 1, figs. 19-20, 1902. Umbilical and marginal nodes, 25 marginal nodes per whorl; some intercalated ribs; marginal shoulder ill-defined. Umbilicus one-fourth diameter.

knighteni Anderson. Anderson, p. 119, pl. 1, figs. 1-4, pl. 2, figs. 39-40, 1902. Umbilical and marginal nodes, 30 marginal nodes per whorl; no intercalated ribs; marginal shoulder ill-defined. Umbilicus one-third diameter.

I. Median-ventral nodes equal in number to the marginal nodes.

2. Ribs sigmoid.—Continued.

B. Keel smooth; ribs weak.

sequens Grossouvre. Grossouvre, p. 64, pl. 3, fig. 1, 1894. Ribs broad, persistent into late stages; marginal nodes persistent. Umbilicus one-fourth diameter.

boisselleri Grossouvre. Grossouvre, p. 65, pl. 3, fig. 3, 1894. Ribs narrow, persistent, fewer than in *sequens*; marginal nodes persistent. Umbilicus one-third diameter.

II. Median ventral nodes two or three times as numerous as marginal nodes.

tunetanum (Thomas and Peron). Peron, p. 21, pl. 17, figs. 6-8, 1893. Ribs and nodes persistent; 6 umbilical nodes, 24 marginal nodes, 58 median ventral nodes per whorl. Umbilicus one-fifth diameter.

inermis Pervinquier. Pervinquier, p. 382, pl. 12, fig. 11, 1907. Ribs and nodes distinct in earlier stages, only umbilical nodes persist in later stages and venter becomes rounded. Umbilicus one-fourth diameter.

III. Keel smooth at all stages.

desmoulinsi Grossouvre. Grossouvre, p. 51, pl. 2, fig. 6, 1894; Solger, p. 167, text figs. 53 a-b, 1904.

SCOPE OF THE GENUS

Barroisiceras as conceived both by the proposer and by later authors seems to have an exceedingly wide scope and to include species departing much from the genotype species *Barroisiceras haberfellneri*. Some of this diversity in form and sculpture is due to ignorance of the stages of development of certain species—that is, only early stages of some species are known and only late stages of others, to the effect that they seem more strikingly unlike than they would be if similar stages were compared. Possibly some of the range of difference is accidental and is due to greater or lesser mechanical deformation of the specimens, presence or absence of the shell, difference in degree of corrosion by weather, or other accidental conditions. Some of it is undoubtedly real.

Groups that seem to the writer to be inappropriate associates of *Barroisiceras haberfellneri* are (1) the species which have a continuous keel throughout life, as *B. desmoulinsi* (according to Solger); (2) the species with sigmoid ribs, as *B. siskiyouense*, *B. knighteni*, *B. sequens*, and *B. boisselleri*; and (3) the species with median-ventral nodes several times as numerous as the marginal nodes, as *B. tunetanum* and *B. inermis*. These groups are here excluded from the genus.

When these forms are removed from *Barroisiceras* the remaining six groups of species show marked similarities, though there are still some rather striking differences among them. In general the earlier stages

are much more alike than the later stages. The mature *B. haberfellneri*, for example, has a rather broad and concave venter, *B. paeon* has a smooth persistent high keel, *B. harlei* has an obtusely angulate venter, and *B. brancoi* has a rounded venter, though the earlier stages have many features in common. Some adults develop strong sculpture, others are nearly smooth. Some are much compressed shells, some are relatively stout.

All species of *Barroisiceras* have, at least in the early and middle stages, three rows of subequal nodes on the venter—one on the median line and one on each margin, forming a more or less sharply defined ventrolateral shoulder. Each median node is set forward of its corresponding pair of marginal nodes. Most species have also a row of nodes on the umbilical shoulder and some a row on the middle of the flank. The ribs are invariably straight, directed radially, and increase both by forking and intercalation. The suture is moderately dissected, has three or four rounded lateral saddles, all high, and a first lateral lobe as long as or longer than the siphonal lobe. The other lobes are small.

The six groups may be conveniently looked upon as subgenera, though doubtless some of the present-day students of ammonites would consider several of them genera.

The typical group, that of *Barroisiceras haberfellneri* (Hauer), contains small to medium-sized species, usually not much more than 100 millimeters in diameter. The cross section of the whorl is high and moderately compressed. The umbilicus is small, one-fifth to one-eighth the diameter. The ribs are fairly strong and are ornamented by strong umbilical and marginal nodes. Large adults differ much. In *B. haberfellneri* the median-ventral nodes fade out, but the marginal nodes remain and the venter is broad and concave; in *B. paeon* the median nodes fuse into a high smooth keel, but the marginal nodes weaken; in both species the ribs weaken greatly. Here belong *B. haberfellneri*, *B. haueri*, *B. neptuni* (Fritsch and Schlönbach), *B. dentatocarinatum* (Fritsch and Schlönbach), and *B. paeon*. This group is, of course, *Barroisiceras* s. s.

The group of *Barroisiceras dentatocarinatum* (Roemer) contains species that may reach a relatively large size, as much as 200 millimeters in diameter. The cross section of the earlier whorls is subtriangular, of the later whorls high and much compressed, subquadrate in most forms, oval in others. The umbilicus is relatively large, one-fourth or one-fifth the diameter. The ribs are weak in the early stages and disappear later, but the umbilical and marginal nodes remain strong and persistent. The median-ventral nodes remain throughout, becoming a faintly nodose keel. Here belong *B. dentatocarinatum*, *B. petrocori-*

ense, *B. dartoni*, *B. nicklesi* (Grossouvre), *B. nicklesi* (Boule, Lemoine, and Thevenin), and *B. nardini*. For this subgeneric group the name *Texasia* is here proposed.

The group of *Barroisiceras alstadenense* contains small to medium-sized species, probably not exceeding 100 millimeters in diameter. The cross section of the whorl is high and moderately compressed. The umbilicus is of medium size, one-fifth or one-sixth the diameter. The ribs are fairly strong and ornamented by a median-lateral row of nodes as well as umbilical, marginal, and median-ventral nodes. Here belong *B. alstadenense* (Schlüter), *B. alstadenense* (Solger), and *B. sevierense*. For this subgeneric group the name *Alstadenites* is proposed.

The group of *Barroisiceras forresteri* contains species that attain a large size, as much as 200 millimeters in diameter. The cross section of the whorl is stout, subquadrate. The umbilicus is relatively large, one-third or one-fourth the diameter. The ribs are weak, but the umbilical, median-lateral, marginal, and median-ventral nodes are strong, the median-lateral nodes in the later stages of some species becoming blunt spines. Here belong *B. forresteri*, *B. allaudi*, *B. stantoni*, and *B. hobsoni*. For this subgeneric group the name *Forresteria* is proposed.

The group of *Barroisiceras harlei* contains small to medium-sized species, not much exceeding 100 millimeters in diameter. The cross section of the whorl is high and much compressed. The umbilicus is small, one-eighth the diameter. The sculpture is very weak; ribs weak or absent, marginal nodes only moderately strong, median-ventral weak, umbilical weak or absent. In late stages the shell is nearly smooth, with venter obtusely angulate. Here belong *B. harlei*, *B. byzacenicum*, and *B. castellense*. For this subgeneric group the name *Harleites* is proposed.

The group of *Barroisiceras brancoi* Solger contains fairly large shells, as much as 200 millimeters in diameter. The cross section is high and much compressed. The umbilicus is relatively large, one-fourth or one-fifth the diameter. The sculpture is very weak; ribs weak, the marginal and median-ventral nodes somewhat stronger, umbilical nodes very weak or absent. In adults the median-ventral nodes disappear and the venter is rounded. Here belong *B. brancoi* var. *mite* and *B. romieuxi*. *B. brancoi* var. *armatum* develops large, distant, blunt spines but otherwise agrees and may be tentatively included. For this subgeneric group the name *Solgerites* is here proposed.

Barroisiceras is superficially much like certain forms assigned to *Prionotropis* Meek of the Turonian. It has been much debated, for example, whether to admit *Ammonites fleurbaeianus* D'Orbigny³¹ into

³¹ D'Orbigny, Alcide, Paléontologie française, Terrain crétacé, Céphalopodes, p. 350, pl. 107, 1841.

Barroisiceras, but it would seem better placed in *Prionotropis*, though certainly not typical. *Prionotropis* has simple ribs inclined forward on the flanks and bent sharply forward on the venter, of unequal prominence in the early stages, more nearly equal in the later stage. There are no umbilical nodes, but double marginal nodes; and the ventral nodes in early stages form a true, individualized keel. The umbilicus is relatively large. Several other genera also have been brought into comparison by authors. *Gauthiericeras* Grossouvre is separable by its continuous keel at all stages, simple ribs, and wide umbilicus. *Tissotia* Douvillé is easily separated by the suture, particularly by the entire saddles, and the continuous keel. *Heterotissotia* Peron has a truncated venter and lacks the median-ventral nodes. *Pseudotissotia* Peron has a continuous keel and very small umbilicus and differs in sutural detail.

NORTH AMERICAN SPECIES OF BARROISICERAS

Barroisiceras (Texasia) *dentatocarinatum* (Roemer) Lasswitz

Plate 3, Figures 1-10; Plate 4, Figures 1-3; Plate 5, Figure 1

1849. *Ammonites dentato-carinatus* Roemer, Texas, p. 417.
 1852. *Ammonites dentato-carinatus* Roemer, Die Kreidebildungen von Texas, p. 33, pl. 1, figs. 2a, b, c.
 1904. *Schloenbachia* (*Barroisiceras*) *dentato-carinata* (Roemer). Lasswitz, Paleont. Abh., n. F., vol. 6, p. 249.
 1926. *Barroisiceras haberfellneri* (Hauer) (part). Scott, Grenoble Univ. Annales, new ser., sci. sec., vol. 3, p. 109.
 1928. *Barroisiceras dentatocarinatum* (Roemer). Adkins, Texas Univ. Bull. 2838, p. 252.
 Not 1872. *Ammonites dentato-carinatus* Roemer. Fritsch and Schlönbach, Cephalopoden der böhmischen Kreideformation, p. 32, pl. 16, figs. 1-3.
 Not 1892. *Ammonites dentato-carinatus* Roemer. Whitfield, U. S. Geol. Survey Mon. 18, p. 250, pl. 41, figs. 3-4.
 Not 1907. *Barroisiceras dentato-carinatus* (Roemer). Weller, New Jersey Geol. Survey Paleont. Ser., vol. 4, p. 836, pl. 101, figs. 5-6.

Diameter of shell, 3 inches (75 millimeters); height of last whorl, 1 inch 5 lines (35 millimeters); height of next to last whorl, 8 lines (17 millimeters).

Shell discoid, compressed, umbilicate, keeled on the back (venter), ornamented on the flanks with nodes and poorly defined ribs. The whorls increasing rapidly in height, slowly in width, two-thirds covered. The flanks flat, almost parallel. The keel is interrupted and consists of large sharp-edged compressed teeth with rounded points. The back (venter) is bordered on either side by a row of nodes, which stand opposite the teeth of the keel and are 24 per whorl in number. From each of these nodes a weak fold runs toward the umbilicus. The most of these disappear, however, on the middle of the flank or beyond it. Only a few folds, indeed each third or fourth, reach the umbilicus and end in a blunt node standing on the edge of the steeply descending umbilical wall. Six such nodes are present on each side of a whorl. The lobes of the septum are strongly dissected and branched. Individual branches of the lobes are very slender and run out into pointed ends. The dorsal (ventral) lobe almost as deep as the first lateral lobe; the second lateral lobe much less deep and narrower than the first. In addition an oblique-lying small auxiliary lobe.

This beautiful species, excellently characterized by its flat, discoid form and its keel of distant, compressed teeth, is different from all other known species. * * *

Occurrence: Waterfall of the Guadalupe near New Braunfels. (Translated from Roemer, 1852.)

The great compression of the whorls, at least in part secondary, of all the available specimens and figures of this species makes comparisons of form difficult. It was very likely a much compressed species at all stages, however, even before fossilization. In sculpture its weak ribs from a diameter of 20 millimeters to that of 150 millimeters and the development of blunt spines in the very large stages separate it from most other species with only marginal and umbilical nodes. From *B. petrocoriense* Coquand³² it differs in the earlier stages in its weaker ribs, larger umbilicus, and higher, coarser keel.

One of the specimens here figured, an internal mold collected by L. W. Stephenson, is from the type locality. It is smaller than the type and differs, if Roemer's figure and description are accurate, in that the median-ventral nodes are not opposite those of the margins of the venter, but each lies somewhat forward of the corresponding marginal nodes, as in other species of *Barroisiceras*. Possibly the original description is faulty in this detail, but only the type itself can settle the matter. The umbilicus is a trifle wider and the ribs and nodes somewhat fewer—20 as against 24 noted by Roemer.

A large internal mold, probably representing a nearly complete shell and associated with *Inoceramus* aff. *I. deformis* Meek, was collected by N. H. Darton at a locality north of Hondo, Tex. The earliest whorls exposed, at a diameter of 80 millimeters, are at a larger stage than the type or the other specimens in hand but agree sufficiently well with them to warrant the assignment of the specimen to *B. dentatocarinatum*. The later stages present features of considerable interest. The cross section of the whorl is high, subrectangular. The sculpture continues with little change to the stage at a diameter of 150 millimeters. There the marginal nodes, instead of remaining subequal, begin to differ in size, each third one on the remainder of the shell becoming a prominent blunt spine, whereas the intervening nodes become even smaller than those on the earlier parts of the shell. A little more than the last half whorl of this specimen is unseptate, the maximum diameter being 210 millimeters. The aperture is not preserved.

Another internal mold of part of a whorl, collected by T. W. Stanton at a locality in the Rio Grande Valley, agrees well with the species.

Formation and localities: Austin chalk at the falls of the Guadalupe River, 2 miles below the bridge east of New Braunfels, Comal County, Tex.; Cow Creek below Pinto Creek, about 24 miles below Del Rio,

³² Grossouvre, Albert de, op. cit., p. 51, pl. 2, fig. 5.

Tex.; Verde Creek, 8 miles north of Hondo, Medina County, Tex.

Barroisiceras (Texasia) dartoni Reeside, n. sp.

Plate 6, Figures 8-10; Plate 7, Figures 8-9

One internal mold, somewhat compressed and not showing the sutures, is the basis of this species. Probably the last three-fifths of a whorl represents the living chamber, as the preceding part of the shell is much more compressed. The maximum diameter preserved is 145 millimeters; the earliest stage showing the venter, a volution earlier, is about 70 millimeters in diameter, though the flanks of the next preceding whorl, to a diameter of perhaps 25 millimeters, show in the umbilicus.

Shell a moderately stout disk. Very early stages unknown. Cross section of the whorl oval, twice as high as wide, with flanks evenly convex from the umbilical shoulder to the marginal nodes of the venter and with the ventral slope nearly flat. Umbilicus 41 millimeters wide at the maximum diameter, or two-sevenths the diameter; 25 millimeters at 70 millimeters diameter, or one-third the diameter; umbilical shoulder distinct, slightly rounded; umbilical wall high and at right angles to the flank. Aperture unknown.

Sculpture of the whorl shown in the umbilicus, ending at the diameter of 70 millimeters, consists of 9 poorly defined umbilical nodes and 9 broad, fairly high primary ribs. The next whorl, to the end of the specimen, shows 11 umbilical nodes, some high and distinct, others obscure, perhaps owing to the manner of preservation. The 11 primary ribs on each flank of the whorl are broad and ill defined, though nearly all of them clearly fork, and the resulting secondary ribs end in 20 conical marginal nodes. Corresponding to each transverse pair of marginal nodes and slightly forward of them is a median-ventral node, high, much elongated. In the type specimen, as it now stands, most of these median-ventral nodes are suggested rather than actually represented on the median line, but there is no doubt that they were originally present and perhaps were high and bladelike on the shell itself. The sculpture as a whole is weak.

Suture dimly suggested at several places but nowhere enough to show the gross form.

B. dartoni is characterized by the ovate cross section of the whorl and by the weak sculpture, with only two rows of nodes on the flanks. It is not very much like any of the American species except possibly *B. dentatocarinatum* but differs from it in the shape of the cross section of the whorl and the lesser prominence of the marginal nodes of the later stages. Possibly the form noted on page 19 as *Barroisiceras* sp. is the young of *B. dartoni*, but the writer prefers to hold them separate for the present. None of the European species seems close to *B. dartoni*.

This species is named for Mr. N. H. Darton, who collected the type specimen.

Formation and locality: Austin chalk near the Sabinal-Utopia road, 5 miles north of Sabinal, Uvalde County, Tex., associated with *Inoceramus* aff. *I. deformis* Meek and *Gryphaea* aff. *G. aucella* Roemer.

Barroisiceras (Alstadenites) sevierense Reeside, n. sp.

Plate 4, Figures 4-8

One entirely septate internal mold showing a full whorl and the umbilical part of the preceding whorl is the basis of this species. Maximum diameter preserved is 60 millimeters; earliest stage showing the venter is at 25 millimeters diameter.

Shell a moderately stout disk. Very early stages unknown. Cross section of whorl at 25 millimeters diameter roughly hexagonal; at 60 millimeters somewhat higher and with the flanks somewhat less convex. Umbilicus 14 millimeters wide at 60 millimeters diameter, between one-fourth and one-fifth the diameter; umbilical shoulder distinct, slightly rounded; umbilical wall high and at right angles to the flank. Living chamber and aperture unknown.

Sculpture of the visible part of the whorl, from a diameter of 12 millimeters to that of 25 millimeters, consists of 9 umbilical nodes connected by coarse rounded primary ribs with 9 median-lateral nodes, which lie on the line of involution. The succeeding whorl bears 10 conical umbilical nodes; 10 low, rounded primary ribs; and 10 conical median-lateral nodes, at not quite half the distance across the flank. At the line of the median-lateral nodes several of the ribs fork and several secondary ribs are intercalated, with the effect that there are 16 secondary ribs which end at 16 marginal nodes, somewhat elongated transversely. On the median-ventral line there are 16 elongated nodes only faintly connected with the corresponding pairs of marginal nodes. The ribs are of even height throughout and the sculpture as a whole only moderately strong.

Suture moderately dissected, the first lateral lobe subequal to the siphonal lobe and the second lateral lobe much smaller; no distinct third lobe. First lateral saddle about one and one-half times the width of the first lateral lobe. Lobes and saddles both rounded in contour, though the lobes are trifold.

B. sevierense is characterized by its moderate stoutness, narrow umbilicus, and evenness and persistence of the sculpturing, with its three rows of nodes and connecting ribs. It resembles the younger stages of *B. stantoni*, but differs in its more compressed shell, less numerous ribs, and small umbilicus. From *B. hobsoni* it differs at all stages in its compressed shell and narrower umbilicus; in later stages it lacks the large spines of *hobsoni*. It is most like *B. alstadenense* (Schlüter)³³ but is stouter and has more persistent, stronger, and coarser sculpture. From *B. alstadenense*

³³ Schlüter, Clemens, op. cit., p. 151, pl. 40, figs. 13-16. Grossouvre, Albert de, op. cit., p. 51, pl. 1, fig. 4; pl. 2, fig. 4.

Solger (not Schlüter)³⁴ it differs in its more persistent and coarser sculpture, having scarcely two-thirds as many ribs and nodes.

The specific name is derived from Sevier County, Utah, where the specimen was found by the late Robert Forrester, of Salt Lake City, Utah.

Formation and locality: Mancos shale, 200 feet above the Ferron sandstone member, at a locality in Sevier County, Utah, 4 miles east of Oak Spring and about 12 miles west of south of Emery. In the same beds were *Barroisiceras forresteri*, *B. castellense*; species as yet unnamed of *Scaphites*, *Baculites*, *Placenticeras*, "*Helicoceras*," and *Eutrophoceras*; *Inoceramus deformis* Meek, and other pelecypods. At near-by localities the upper part of the Ferron sandstone member contains *Prionocyclus wyomingensis* Meek, *P. macombi* Meek, *Prionotropis hyatti* Stanton, *Scaphites warreni* Meek and Hayden, *Ostrea lugubris* Conrad, and *Inoceramus fragilis* Hall and Meek.

***Barroisiceras (Forresteria) forresteri* Reeside, n. sp.**

Plate 5, Figures 2-7

One entirely septate internal mold showing parts of two whorls is the basis of this species. The entire whorl from a diameter of 13 millimeters to that of 28 millimeters is present, though only about half of it is completely exposed; and the half whorl from a diameter of 42 millimeters to that of 55 millimeters is preserved.

Shell a very stout, spinose ovoid. At a diameter of 14 millimeters the width of the whorl is three-fourths the height (4.5 by 6 millimeters) but gradually changes until at the diameter of 28 millimeters the whorl is as wide as high, excluding the nodes, and one-fifth wider than high, including the nodes (16 by 13 millimeters). At about 50 millimeters diameter the whorl is 25 millimeters high and 25 millimeters wide, excluding the nodes, and 33 millimeters wide across the nodes. The general aspect of the later cross-section is depressed hexagonal. Umbilicus between one-third and one-fourth the diameter; umbilical shoulder fairly distinct and somewhat rounded; umbilical wall steep. Living chamber and aperture unknown.

Sculpture from 14 millimeters diameter to 20 millimeters diameter, a half whorl, shows no umbilical nodes; 6 rounded primary ribs which end in conical median-lateral nodes and there mostly divide into secondary ribs, which in turn, end in conical marginal nodes 10 in number; median-ventral nodes, each placed somewhat forward of the corresponding marginal nodes. On the succeeding half whorl, to 28 millimeters diameter, weak umbilical nodes appear and the median-lateral and marginal nodes increase in relative strength. On the final half whorl preserved

in the type the umbilical nodes are still weak, the ribs very weak, but the median lateral nodes have become blunt spines; the marginal nodes are still strong, but the median-ventral nodes are relatively weaker.

The suture shows the siphonal and first lateral lobes subequal in length, the second lateral lobe short, and the third very small; the first lateral saddle a little wider than the siphonal lobe; the first lateral lobe rounded-trifid, the second lateral lobe almost on the umbilical shoulder.

Barroisiceras forresteri is characterized by its stout shell and strong sculpture, particularly the development of the median-lateral and marginal nodes into blunt spines. The writer knows no close American relatives. *B. desmoulinsi* Grossouvre³⁵ has the general aspect of *B. forresteri* but lacks the median-lateral nodes and is said to have a smooth, continuous keel at all stages.³⁶

B. forresteri seems very close indeed to the form from the Senonian of Diego-Suarez, Madagascar, described by Boule, Lemoine, and Thevenin³⁷ as *Acanthoceras (Prionotropis) allaudi*, which seems to the writer to be a species of *Barroisiceras*. *B. forresteri* differs chiefly in its fewer ribs and nodes.

The species is named for the late Robert Forrester, of Salt Lake City, Utah, who collected the type.

Formation and locality: Same as for *B. sevierense*.

***Barroisiceras (Forresteria) stantoni* Reeside, n. sp.**

Plate 7, Figures 1-7; Plate 8, Figures 1-3; Plate 9, Figure 1

This species is based on two internal molds from the same locality—a larger one, chosen as the type, with a maximum diameter of 130 millimeters, and a smaller one, with a maximum diameter of 39 millimeters. The part of the shell at less than 50 millimeters diameter shows only in the umbilicus of the larger specimen, and that below 14 millimeters only in the umbilicus of the smaller specimen.

Shell a thick disk, of medium size for the genus. Cross section roughly hexagonal from a diameter of 14 millimeters to 80 millimeters (about the position of the last septum of the type), being relatively high in the early stages and much more depressed and broad-ventered in the later stages; cross section of the living chamber subquadrate. Umbilicus 40 millimeters wide at the end of the type, a little less than one-third the diameter, but in the earlier stages it is proportionately smaller, being a little more than one-fifth the diameter at 39 millimeters. Umbilical shoulders abrupt at all stages seen, with inner wall nearly at right angles to the flank. Living chamber of type occupies three-fourths of last whorl, aperture unknown.

³⁵ Grossouvre, Albert de, op. cit., p. 51, pl. 2, fig. 6.

³⁶ Solger, Friedrich, op. cit., p. 167.

³⁷ Boule, Marcelin, Lemoine, Paul, and Thevenin, Armand, op. cit., p. 32, pl. 8, figs. 6-7, text fig. 17.

³⁴ Solger, Friedrich, op. cit., p. 170, pl. 5, fig. 6.

Sculpture at the diameter of 10 millimeters shown only in the umbilicus of the smaller specimen, where there are rather coarse primary ribs without well-defined umbilical nodes; any other nodes that may be present are covered by the succeeding whorl. At 14 millimeters diameter umbilical, median-lateral, marginal, and median-ventral nodes are present, numbering on the succeeding whorl (to 39 millimeters diameter) 11 umbilical, 12 median-lateral, 19 marginal and median-ventral; the umbilical and median-lateral nodes are conical, the marginal and median-ventral elongated; 5 of the primary ribs fork at the median-lateral line of nodes (outside the mid line of the flank), and there are two intercalated secondary ribs; ribs of even height throughout. At a diameter of 50 millimeters the umbilical and median-lateral nodes, both blunt conical, and the connecting ribs begin to increase in relative prominence and the median row shifts toward the umbilicus; on the other hand the secondary ribs on the outer part of the flank decrease much in prominence, though the marginal tubercles remain high; the median-ventral nodes decrease somewhat in height. The last half whorl of the type, from 80 millimeters to 130 millimeters diameter, is much corroded, but apparently the median-ventral nodes are distinct to the end of the shell, the umbilical and median-lateral nodes and the primary ribs fuse into a lateral rib, and the marginal nodes become more prominent.

The suture at 25 millimeters diameter shows the usual character of moderate dissection; first lateral lobe subequal to the siphonal lobe; second lateral lobe much smaller; an ill-defined, broad third lobe; first lateral saddle about twice as broad as the first lateral lobe. At 65 millimeters diameter the suture is much the same, with all the elements rather rounded terminally.

B. stantoni is characterized by its relatively wide umbilicus in the later stages, its stout shell with hexagonal cross section of the whorl passing into subquadrate, the prominence of the umbilical and median-lateral nodes and the connecting primary ribs, and the persistence of the marginal and median-ventral nodes. In the early stages it resembles *B. sevierense* somewhat but is much stouter at equal diameters and has more numerous ribs. In the later stages it is somewhat like *B. hobsoni* but differs in its broader venter, the lack of large spines, and coarser sculpture. No species outside of America is very close in the later stages, though *B. alstadenense* (Schlüter)³³ resembles it in the early stages, being separable by weaker sculpture and more compressed shell. *B. alstadenense* Solger (not Schlüter)³⁹ also is more compressed and has less conspicuous median-lateral nodes.

The species is named for Dr. T. W. Stanton, who collected the type and paratype.

Formation and locality: A sandstone in T. 33 N., R. 99 W., southeast of Lander, Wyo., included in the Frontier formation. The associated species include *Scaphites ventricosus* Meek and Hayden, *Scaphites* sp. undescribed, *Inoceramus* aff. *I. fragilis* Hall and Meek, *I. stantoni* Sokolow, and other pelecypods and gastropods. A sandstone 200 feet higher contains *Scaphites ventricosus*, *Scaphites* sp. undescribed (same as above), *Placenticeras pseudoplacenta* Hyatt, *Inoceramus stantoni*, *I.* aff. *I. erectus* Meek, and other mollusks. A third sandstone, apparently 300 feet higher still but possibly a duplication of the last, constituting the highest member of the Frontier, contains *Scaphites ventricosus*, *Mortoniceras shoshonense* Meek, *Baculites codyensis* Reeside, *Inoceramus stantoni*, *I. umbonatus* Meek and Hayden, and other mollusks. A sandstone 150 feet below that containing *B. stantoni* contains *Inoceramus* sp. and fossil plants⁴⁰ and is the base of the Frontier formation.

***Barroisiceras (Forresteria) hobsoni* Reeside, n. sp.**

Plate 9, Figures 2-4; Plate 10, Figures 1-2

A single entirely septate internal mold with a maximum diameter of 170 millimeters is the basis of this species.

Shell a stout disk, large for the genus, for a complete shell would certainly exceed 225 millimeters in diameter. Early stages unknown. At a diameter of 75 millimeters the cross section of the whorl is roughly hexagonal, but in the succeeding whorl (to 170 millimeters) it becomes more nearly subquadrate. Living chamber and aperture unknown. Umbilicus wide for the genus, 58 millimeters at a diameter of 170 millimeters or one-third the diameter; umbilical shoulder distinct and rather sharp; umbilical wall at right angles to the flank.

Sculpture at earliest stage seen, the half whorl from 70 millimeters to 90 millimeters diameter consists of 7 primary ribs passing from a very weak umbilical node to the middle of the flank, where each bears a low but distinct node; 4 of the primary ribs fork at the median-lateral node and the ribs then pass to the 11 rather high marginal nodes; from these faint ribs run diagonally forward to the high, much elongated, median-ventral nodes, which form a coarsely serrate keel. On the succeeding three-fourths of a whorl (to 170 millimeters diameter) the umbilical nodes and primary ribs fade out completely; the median-lateral nodes gradually change in prominence, so that each third node becomes a large blunt spine and the others weaken; the spines move outward, so that the last preserved is nearly flush with the ventral surface; the

³³ Schlüter, Clemens, op. cit., p. 151, pl. 40, figs. 13-16. Grossouvre, Albert de, op. cit., p. 51, pl. 1, fig. 4, pl. 2, fig. 4.

³⁹ Solger, Friedrich, op. cit., p. 170, pl. 5, fig. 6.

⁴⁰ Berry, E. W., The flora of the Frontier formation: U. S. Geol. Survey Prof. Paper 158, pp. 129-135, pls. 20-21, 1930.

marginal nodes become coarser and blunt but relatively lower; the median-ventral nodes begin to lose their distinctness, at least on the internal mold, and appear to unite in a nearly smooth low keel.

Suture not well preserved, but enough may be discerned to show a long, slender first lateral lobe; first lateral saddle nowhere clear but seems to be about twice as wide as the first lateral lobe; second lateral lobe small and near the umbilical shoulder.

B. hobsoni is best characterized by its relatively wide umbilicus, fairly stout shell with hexagonal cross section passing into subquadrate, and the stout, widely spaced spines of the later stages. It is not very close to any species outside of America. *B. stantoni* is most like *hobsoni* in the earlier stages but may easily be separated by its broader venter and coarser sculpture—fewer ribs per whorl, more conspicuous umbilical nodes and primary ribs. In the later stages the umbilical nodes persist, and most other features of the ornamentation differ. *Barroisiceras* sp. No. 7 of Burckhardt⁴¹ has stout median-lateral nodes but seems to have a rather small umbilicus.

The species is named for Mr. W. A. Hobson, of Carlile Springs, Colo., who found the type specimen.

Formation and locality: The exact locality and horizon are not recorded, but there is little doubt because of the constitution of the matrix, that it came from the Timpas limestone, of Niobrara age, somewhere in the vicinity of Carlile Springs, Colo. The matrix contains abundant fragments of the shell of *Inoceramus* and abundant *Globigerina*.

***Barroisiceras (Harleites) castellense* Reeside, n. sp.**

Plate 6, Figures 1–5

One entirely septate internal mold showing a complete whorl from the diameter of 20 millimeters to that of 48 millimeters and small parts of the inner whorls is the basis of this species.

Shell a compressed disk. Cross section of the whorl a high oval, nearly symmetrical, with widest part about the middle; at latest stage preserved the cross section is 28 millimeters high and 16 millimeters wide. Inner whorls below 16 millimeters diameter much stouter in proportions, though still oval in cross section. Umbilicus narrow, 5 millimeters wide at 48 millimeters diameter—that is one-ninth the diameter; umbilical shoulder sharp and inner wall steep. Living chamber and aperture unknown.

Sculpture of the outer whorl of the type shows 8 low but distinct conical umbilical nodes, from each of which a flattened low primary rib passes outward to the middle of the flank, there passing into several obscure secondary ribs; other secondary ribs are inter-

calated. All these ribs are plainer on the early part of the whorl and decrease in distinctness toward the later part, suggesting that still later whorls would be smooth. The parts of the earlier whorls seen, particularly from 4 to 11 millimeters diameter, show about 25 distinct ribs per whorl on the outer part of the flank, though the umbilical part shows only weak, distant ribs and no nodes. On the outer whorl the rather obscure ventrolateral shoulder is marked by a row of 38 rounded nodes, from which weak ribs run diagonally forward to the median-ventral nodes.

The suture shows a relatively slender first lateral lobe only slightly longer than the siphonal lobe, small second lateral lobe, and very small third lateral lobe. First lateral saddle about one and one-half times as wide as the siphonal lobe.

B. castellense is characterized by its compressed form, the weak sculpture, umbilical nodes, and the oval cross section of the whorl. It is most like *B. harlei* Grossouvre⁴² but differs in the umbilical nodes, greater persistence of both ribs and nodes, lesser distinctness of the ventrolateral shoulder, and the oval cross section of the whorl. From *B. byzacenia* Pervinquier⁴³ it differs in the oval cross section of the whorl and the relatively persistent ribs and nodes, though resembling it in the presence of umbilical nodes.

The name is derived from that of Castle Valley, Utah, the physiographic feature formed by the Mancos shale of the region where the type was found by the late Robert Forrester.

Formation and locality: Mancos shale, 200 feet above the Ferron sandstone member, at a locality in Sevier County, Utah, 4 miles east of Oak Spring and 12 miles south of Emery.

***Barroisiceras* sp.**

Plate 6, Figures 6–7

A single much compressed, entirely septate internal mold preserving nearly half a whorl with a maximum diameter of 80 millimeters is related to *B. dentatocarinatum* in its possession of weak ribs but differs in lacking well-defined, strong umbilical and marginal nodes, though both are present in feeble development. The suture is much like that of *B. dentatocarinatum*. Better material is needed before adequate description may be made, and the specimen would best remain unnamed, though it is possibly a new species.

Formation and locality: Austin chalk on Cow Creek below Pinto Creek, about 24 miles below Del Rio, Tex., associated with *B. dentatocarinatum*.

⁴² Grossouvre, Albert de, op. cit., p. 51, pl. 2, figs. 2, 7, 8. Boule, Marcellin, Lemoine, Paul, and Thevenin, Armand, op. cit., p. 49, pl. 11, fig. 4. Solger, Friedrich, op. cit., p. 172, text figs. 58–61.

⁴³ Pervinquier, Léon, op. cit., p. 381.

⁴¹ Burckhardt, Carlos, op. cit., p. 107, pl. 25, figs. 16, 17.

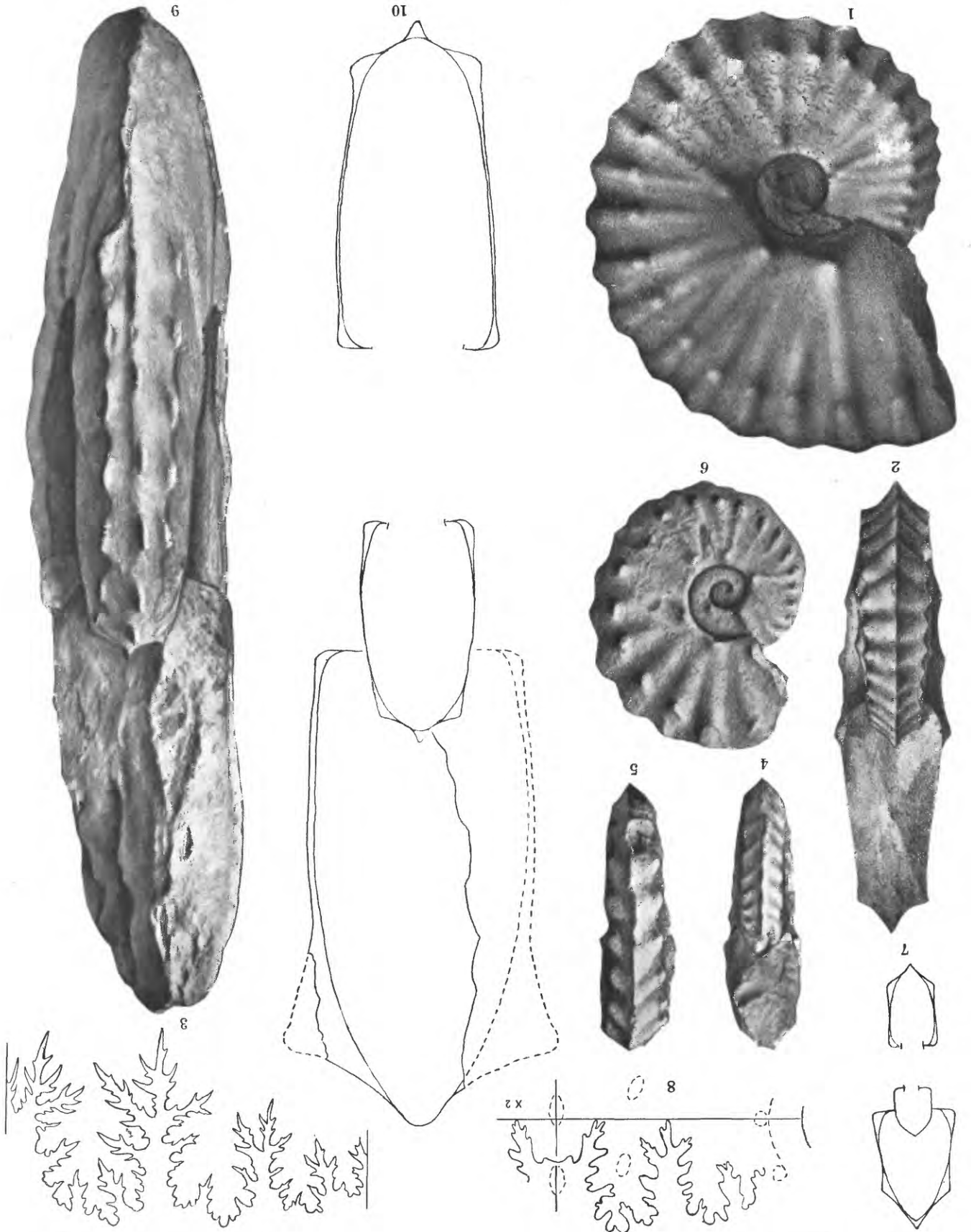
PLATES 3-10

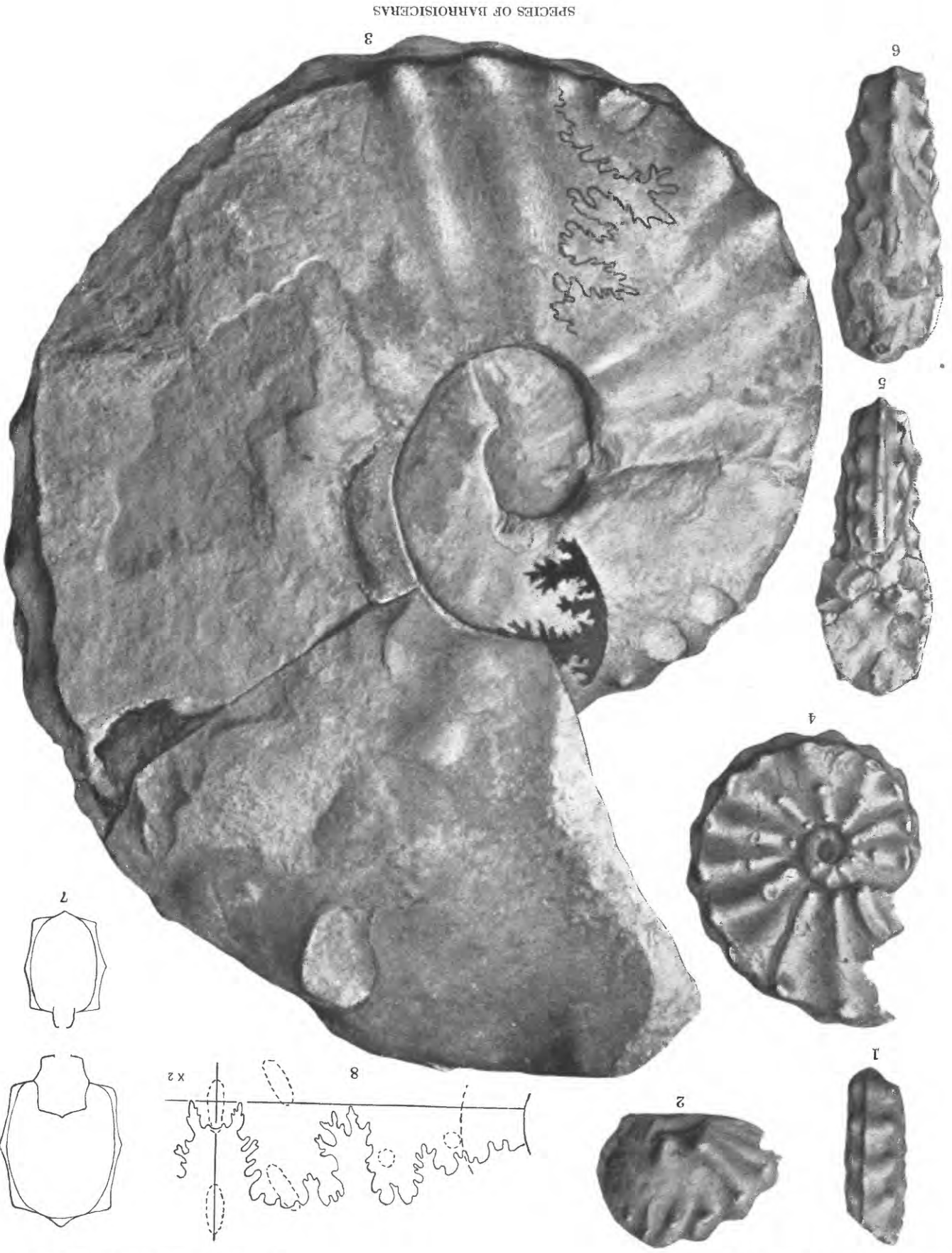
PLATE 3

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- 1-10. *Barroisiceras (Texasia) dentatocarinatum* (Roemer) Lasswitz -----
1-3. Side and front view and suture of the type specimen, from the Austin chalk at the falls of the Guadalupe River, 2 miles below the bridge east of New Braunfels, Comal County, Tex. (Copied from Roemer, Die Kreidebildungen von Texas, pl. 1, figs. 2a-c, 1852.)
4-8. Front, rear, and side views, cross section, and suture at diameter of 45 millimeters of a small, entirely septate internal mold from the type locality of the species. U. S. Nat. Mus. catalogue No. 73753.
9-10. Front view and cross section of a nearly complete internal mold from the Austin chalk on Verde Creek, 8 miles north of Hondo, Medina County, Tex. U. S. Nat. Mus. catalogue No. 73754.

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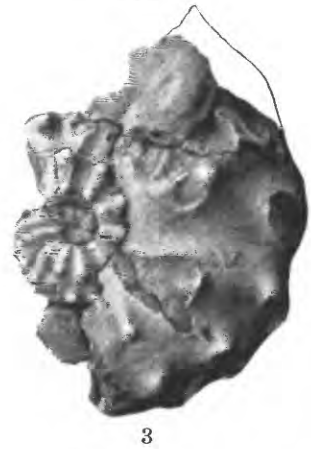
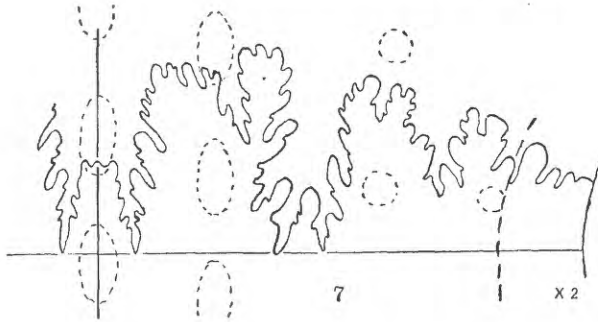
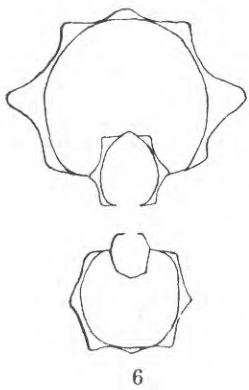
SPECIES OF BARROISICERAS

PLATE 4

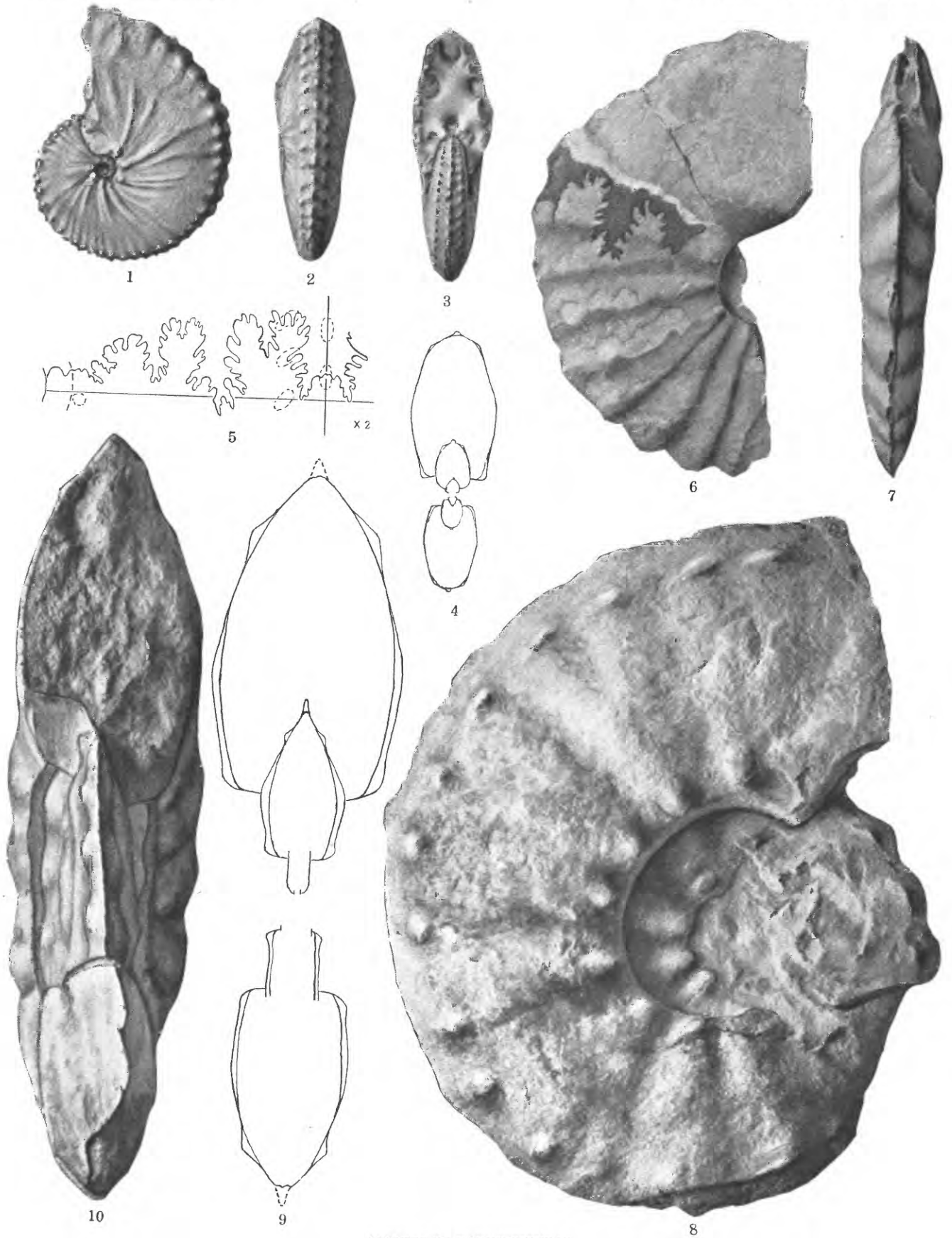
1-3. <i>Barroisiceras (Texasia) dentatocarinatum</i> (Roemer) Lasswitz	Page 15
1-2. Peripheral and side views of a fragment from the Austin chalk on Cow Creek below Pinto Creek, about 24 miles below Del Rio, Tex. U. S. Nat. Mus. catalogue No. 73755.	
3. Side view of specimen shown in Plate 3, Figures 9-10.	
4-8. <i>Barroisiceras (Alstadenites) sevierense</i> Reeside, n. sp., side, front, and rear views, cross section, and suture at diameter of 42 millimeters of the type, an entirely septate internal mold from the Mancos shale, 200 feet above the top of the Ferron sandstone member, at a locality in Sevier County, Utah, 4 miles east of Oak Spring and 12 miles south- west of Emery. U. S. Nat. Mus. catalogue No. 73756.	16
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PLATE 5

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2-7. <i>Barroisiceras</i> (<i>Forresteria</i>) <i>forresteri</i> Reeside, n. sp., two side views, front and rear views, cross section, and suture at diameter of 36 millimeters of the type, an entirely septate internal mold from the Mancos shale, 200 feet above the top of the Ferron sandstone member, at a locality in Sevier County, Utah, 4 miles east of Oak Spring and 12 miles southwest of Emery. U. S. Nat. Mus. catalogue No. 73757.....	17



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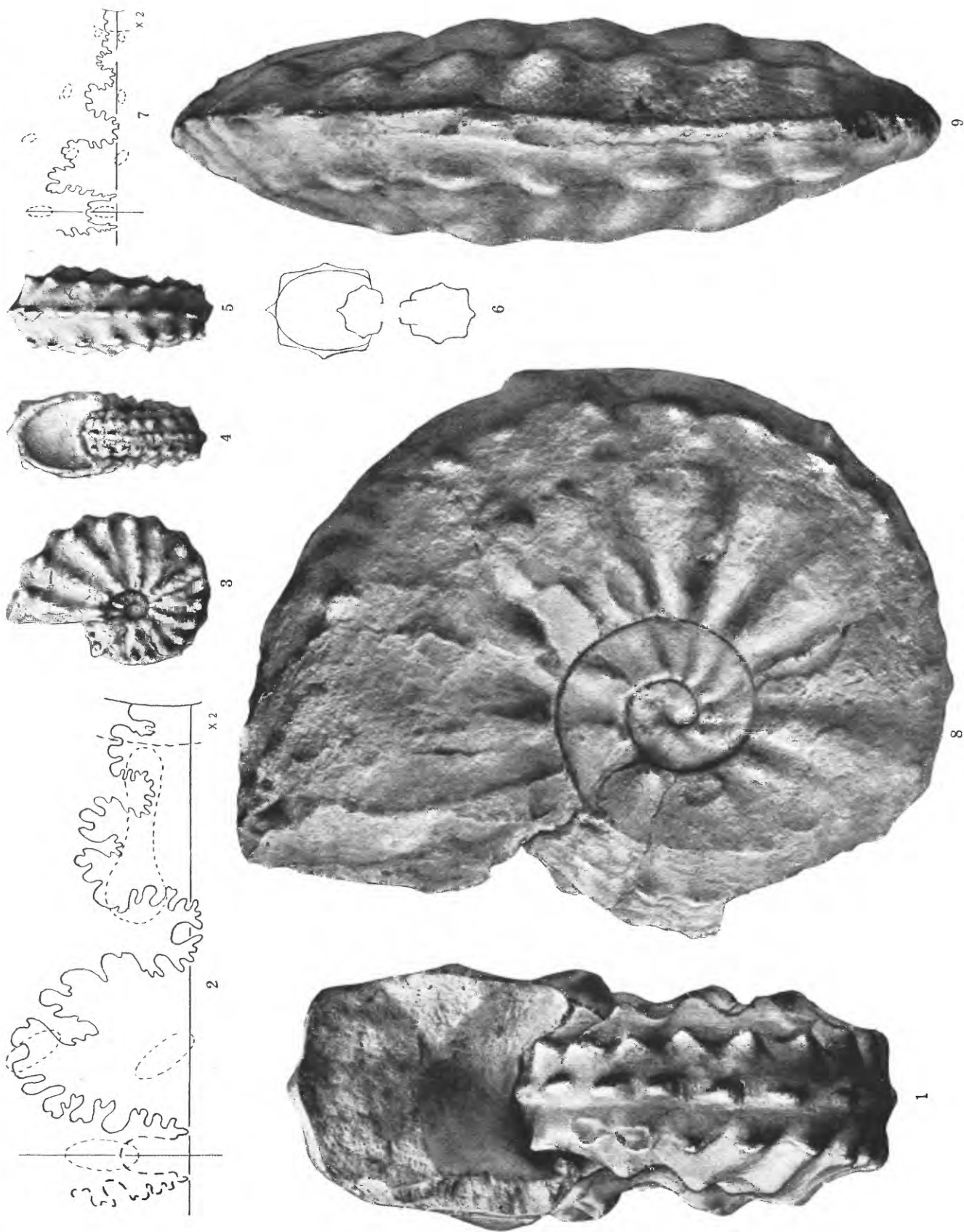
SPECIES OF BARROISICERAS

PLATE 6

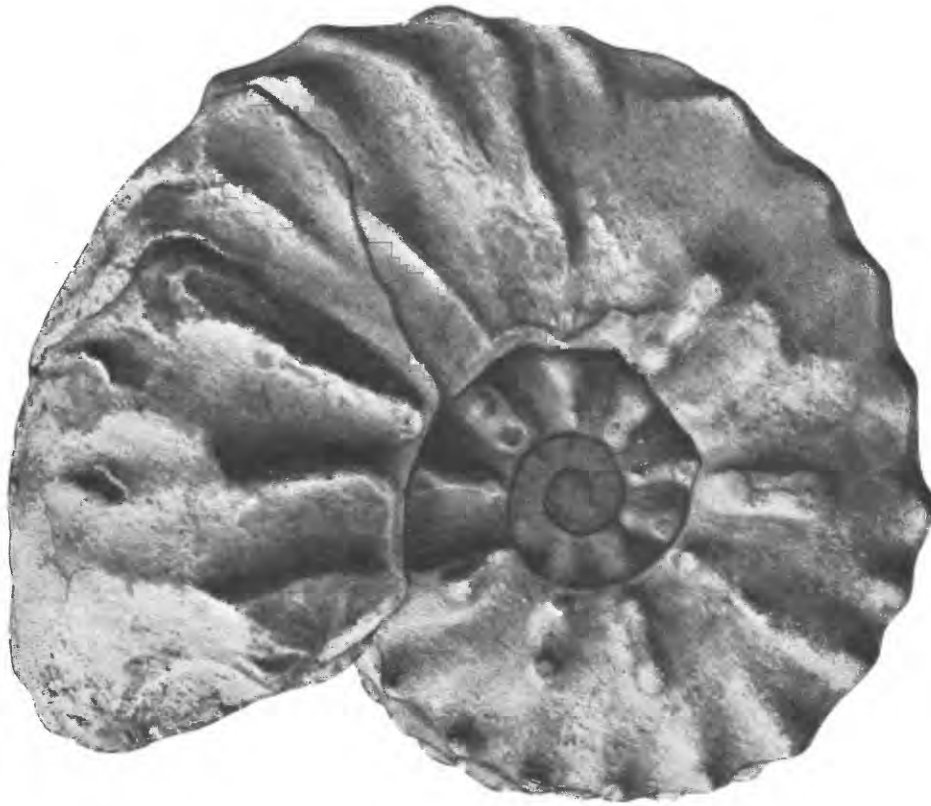
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1-5. <i>Barroisiceras</i> (<i>Harleites</i>) <i>castellense</i> Reeside, n. sp., side, rear, and front views, cross section, and suture at diameter of 36 millimeters of the type, an entirely septate internal mold from the Mancos shale, 200 feet above the top of the Ferron sandstone member, at a locality in Sevier County, Utah, 4 miles east of Oak Spring and 12 miles southwest of Emery. U. S. Nat. Mus. catalogue No. 73758-----	19
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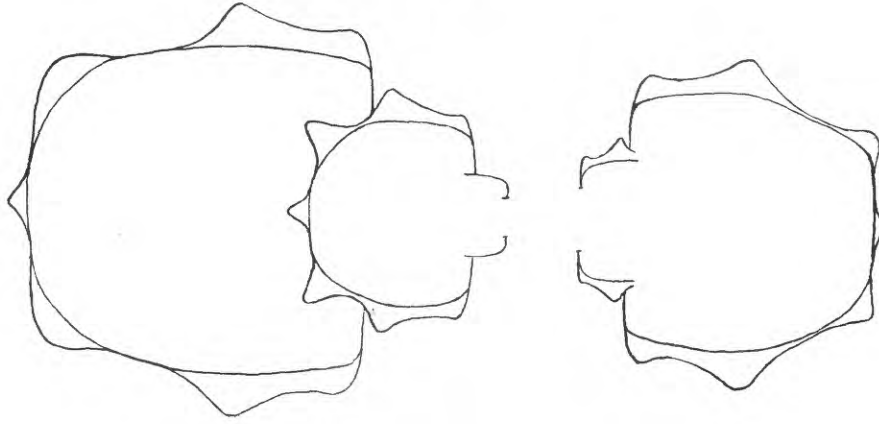
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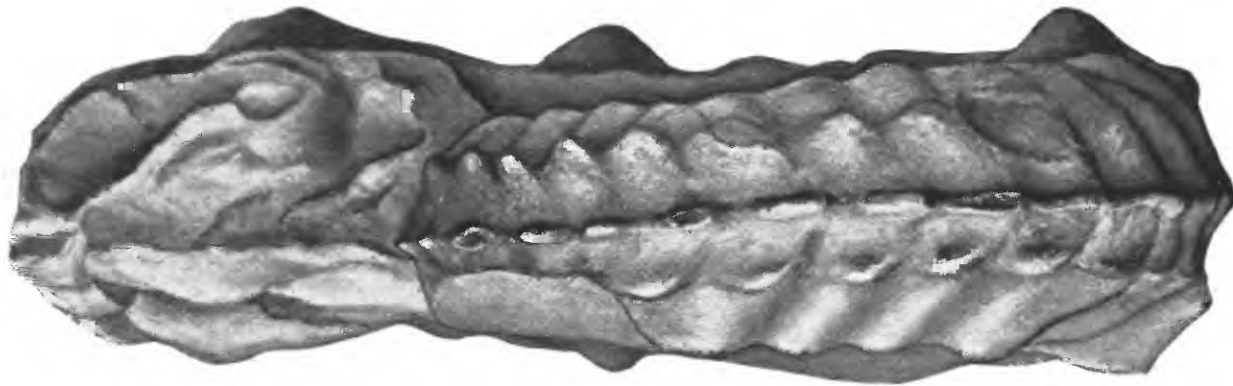


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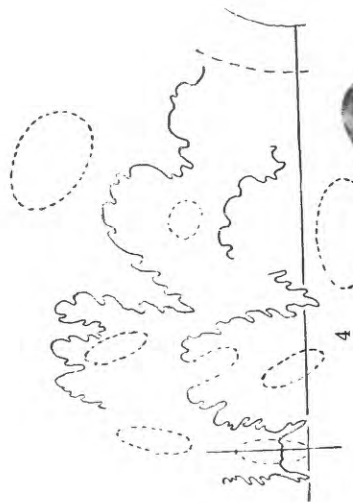


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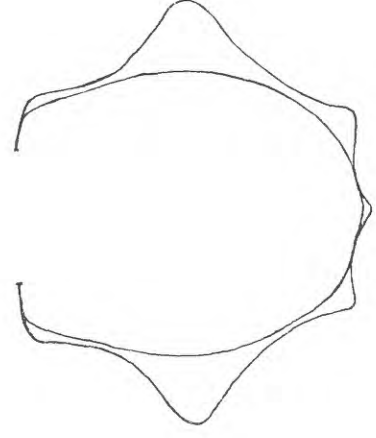
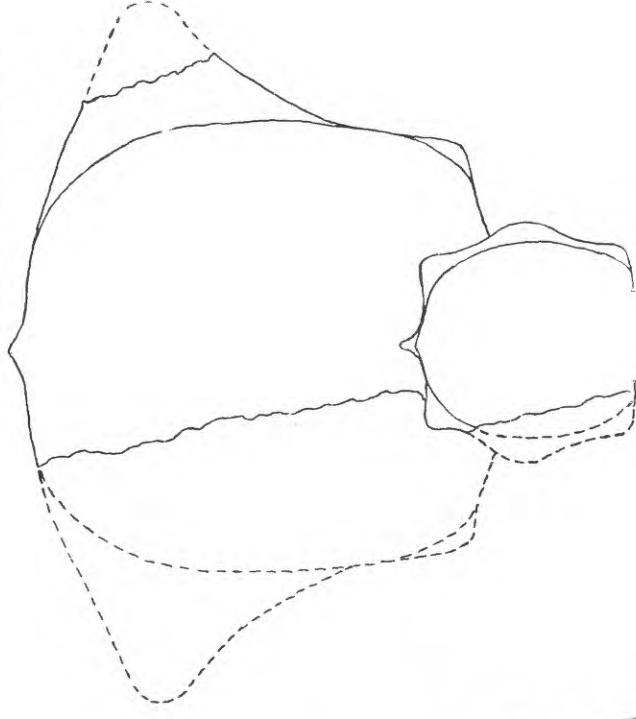
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